Eco-toxicology and control of the Indian Desert Gerbil, *Meriones hurrianae* (Jerdon)

VIII. Body weights, sex ratio and age structure in the population

By

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Introduction

Live Desert Gerbils, *Meriones hurrianae* (Jerdon) were collected from the field for our toxicological work during 1963-64 and 1966-67. Records were maintained with respect to their body weights, sex, and age. During both the periods the site of collection was the same and, therefore, an attempt has been made here to deal with the body weight, sex ratio and age structure found in the desert gerbil population during the two years. Interesting facts about the population structure have come to light.

Methods

During 1963-64, merion gerbils were collected by flooding their burrows with water. No sooner the rodents rushed out, they were scooped with butterfly nets and transferred to cages. During 1966-67, however, they were collected by trapping in Sherman live traps. During both the years they were collected from natural grasslands comprising mainly of *Cenchrus biflorus*, *C. setigerus*, *C. ciliaris*, *Aristida adscensionis* and *Cyperus rotundus*. The site of collection was the Central Research Farm of the Institute situated at Jodhpur. Body weights of gerbils were taken on a triple-beam scale (accuracy 1/10 gm.) soon after their capture. They were sexed. With respect to age, the gerbils were classed into two groups : those weighing below 40 gm. were regarded as subadults and the rest as adults. This categorisation was made following Ghosh (1968) who observed that sexual maturity is attained by them around the body weight of 40 gm.

Observations and Discussion

BODY WEIGHT OF ADULT GERBILS

Body weight trend through the year : The mean monthly body weights of adult desert gerbils fluctuate around 60 gm. during 1963-64 and around 70 gm. during 1966-67 (Table 1). Body weights tend to decline after winter and reach a low in summer, thereafter they increase. A steep peak is, however, observed in June, the hottest month during which climatic conditions are very hostile and there is severe paucity of food. Such a peak has also been observed by my co-worker in the Indian Gerbil, *Tatera indica indica* which were collected from Bikaner (Jain 1970) during 1968. It is difficult to assign any definite reason for this sudden increase in the body weight of adult merion gerbils but in both the species (Prakash 1963 & Jain 1970) a peak is also shown in the reproductive activity in both the sexes. Whether the peaks in reproductive activity and body weights are independent characteristics or whether there is a cause and effect relationship between the two can be ascertained only when further work is done. On the whole, the trend of variations in mean monthly body weights of adult gerbils appear to be parallel to the availability of food in the desert tract. Minimum food is available in natural condition during summer months when all the vegetation dries and, therefore, the body weights are also minimum during these months. During the monsoon and post-monsoon seasons when vegetation is green, the rodents gain body weight. During winter when the vegetation starts drying, the gerbils also start losing body weight and it continues till summer.

Differences between sexes : Male desert gerbils are found to be heavier than the females in all the months except in October, 1966. This difference, however, reached the level of significance (Table 1), only in January, August and September during 1963-64 and in February and August during 1966-67.

Differences between years : The mean monthly body weights of male desert gerbils collected during 1966-67 were higher as compared to those of male gerbils collected during 1963-64 except in January (1963-64) but the difference was statistically significant only during August. Similar was the trend in the body weights of adult female gerbils between the two periods, significant differences (Table 1) being observed in the months of March, July and August. It is noteworthy, that significant differences in the body weight of both the sexes were observed during monsoon season, body weights being heavier in 1966-67 during which year the total precipitation (280 mm.) was more as compared to that in 1963-64 (184 mm.). It may indicate that a greater availability

TABLE 1

MEAN MONTHLY BODY WEIGHTS OF ADULT DESERT GERBILS DURING 1963-64 AND 1966-67 WITH STANDARD ERROR

Month	1963-64		1966-67							
	Male	Female	Male	Female	't' between					
	1	2	3	4	1 & 2	1 & 3	1 & 4	2 & 3	2 & 4	3 & 4
January	79·15 ± 2·14	59·57 ± 3·43	71·04 ± 3·98	66·14 ± 3·16	4·51*	1·81	3·42*	1·80	1·40	0·87
February	68·46 ± 6·75	56·24 ± 2·97	75·61 ± 4·97	62·48 ± 2·31	1·67	1·86	0·84	3·38*	1·68	2·41*
March	63·90 ± 3·83	52·41 ± 1·98	70·67 ± 3·01	68·50 ± 2·54	2·67	0·43	1·00	5·12*	5·05*	0·54
April	54·50 ± 8·94	53·12 ± 2·64	—	—	0·15	—	—	—	—	—
May	59·00 ± 6·40	47·5	—	—	—	—	—	—	—	—
June	75·33 ± 9·47	72·66 ± 11·7	—	—	0·17	—	—	—	—	—
July	46·10 ± 1·00	50·75 ± 2·71	65·80 ± 2·29	66·81 ± 2·10	0·45	1·94	1.93	4·13	4·72*	0·26
August	62·54 ± 1·58	51·71 ± 1·41	73·63 ± 1·75	63·76 ± 2·05	4·53*	4·33*	0·08	9·87*	5·04*	3·71*
September	69·11 ± 2·25	57·34 ± 1·77	79·18 ± 5·41	65·99 ± 5·36	4·17*	1·74	0·54	3·89*	1·54	1·74
October	—	—	74·63 ± 3·35	78·49 ± 2·37	—	—	—	—	—	0·83
December	65·51 ± 3·27	64·05 ± 2·95	74·41 ± 4·28	65·67 ± 3·14	0·33	1·65	0·03	2·00*	0·38	1·65

* Significant at 5 per cent level.

of green food directly influences the health of the rodents resulting in an increased prevalence of pregnancy and in an increase in the litter size (Prakash 1963).

Distribution of body weights in the samples: In Table 2, the body weights of the desert gerbil are classed at 20 gm. intervals. The two classes, up to 20 gm. and 20·1-40 gm. represent subadult gerbils. It is observed that these two classes are not distributed uniformly in the population during 1963-64 whereas during 1966-67, their distribution is more or less regular. Noteworthy is the poor representation of these classes during monsoon which is reported (Prakash 1963) to be the period of their peak littering activity. The weight classes 40·1-60·0 gm. and 60·1 to 80·0 gm. are distributed almost throughout the year in both the sexes during 1963-64, and these two and the 80·1 to 100 gm. class are distributed similarly during 1966-67. It is interesting to note that the 80·1-100 gm. class is very poorly represented during 1963-64. Moreover, the 100·1-120 gm. and 120·1-140 gm. classes are completely absent in both the sexes during 1963-64 whereas they are represented during 1966-67. These observations indicate that during the earlier year the older (heavier) gerbils were not present in the population although the chances of their collection, if they were present, were much more as they were being collected by flooding their tunnels and chances of their escape were minimal. This may be related to the poor feeding conditions available to desert gerbils during the previous year when the rainfall was poor (184 mm.) as compared to 1966-67 (280 mm.).

Age Structure

Adult-subadult ratio : The proportion of subadult gerbils in the population of desert gerbils in 1963-64 was significantly higher than ($d=4·03$) those in the population of 1966-67. It is rather difficult to visualise the possible reasons for this significant difference as it is expected that the number of subadult gerbils should be more during 1966-67 when there was a comparatively larger population of heavier animals and during which year the feeding conditions were also superior to 1963-64. This paradoxical situation may perhaps be explained on the basis of the difference in the modes of collection of the animals during the two years. During 1963-64, they were collected by flooding their warrens with water and, therefore, even those young ones which had not weaned and which did not usually venture out of burrows were also forced to move out and collected. Hence a higher representation of younger animals (20 gms. and below) was found in the population of 1963-64 as compared to that 1966-67 (34 as against 19).

TABLE 2

MONTHLY DISTRIBUTION OF WEIGHT CLASSES OF MALE AND FEMALE DESERT GERBILS DURING 1963-64 AND 1966-67 EXPRESSED AS PER CENT OF MONTHLY COLLECTION

Wt. class/Months	1963-64										1966-67							
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Dec.	Jan.	Feb.	Mar.	July	Aug.	Sept.	Oct.	Dec.
								♂♂										
Up to 20 gm.	—	5·2	7·1	25	12·5	—	—	—	—	—	3·7	7·7	2·3	—	—	—	2·5	—
20·1— 40·0	—	52·6	42·8	—	37·5	—	—	2·5	—	—	33·9	23·0	11·9	2·8	—	17·3	15·0	7·9
40·1— 60·0	—	15·8	50·0	50	25·0	33.3	66·6	42·5	24·0	46·1	20·7	19·2	26·1	38·2	12·0	13·0	27·5	28·9
60·1— 80·0	100	15·8	—	25	25·0	33.3	33·3	52·5	52·0	46·1	20·7	15·3	33·3	38·2	62·0	34·6	20·0	26·3
80·1—100·0	—	10·4	—	—	—	33.3	—	2·5	24·0	7·7	18·8	27·0	21·4	20·6	22·0	21·7	30·0	31·5
100·1—120·0	—	—	—	—	—	—	—	—	—	—	—	7·7	4·6	—	4·0	8·7	5·0	2·6
120·1 & above	—	—	—	—	—	—	—	—	—	—	1·8	—	—	—	—	4·3	—	2·6
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Up to 20 gm.	41·3	7·7	16·3	—	—	—	—	—	—	22·2	—	9·1	11·7	—	—	—	1·8	—
20.1— 40·0	27·5	46·0	32·6	45·4	87·5	16·6	—	8·6	—	16·1	23·7	22·7	23·4	—	—	5·5	12·9	20·4
40.1— 60·0	17·2	27·0	38·1	45·4	12·5	16·6	100	80·0	66·6	22·2	37·2	30·0	17·6	32·3	46·4	50·0	7·3	36·7
60.1— 80·0	13·7	19·2	12·7	9·1	—	33·2	—	11·4	33·3	29·0	22·1	28·7	27·4	58·0	42·8	27·7	38·8	22·4
80.1—100·0	—	—	—	—	—	33·2	—	—	—	9·5	13·5	7·5	19·6	6·4	10·7	11·1	33·3	16·3
100.1—120·0	—	—	—	—	—	—	—	—	—	—	1.6	1·3	—	3·2	—	—	5·5	4·1
120.1 & above	—	—	—	—	—	—	—	—	—	—	1.6	—	—	—	—	5·5	—	—

Table 4 also indicates that the number of male subadult gerbils collected during both the years was significantly less as compared to female subadult gerbils [1963-64—$x^2(1)=28{\cdot}8$, $P < {\cdot}01$; 1966-67—$x^2(1)=16{\cdot}93, P < {\cdot}01$].

It is further clear from Table 3 that the numbers of subadult male and female desert gerbils, during both the years, collected during the

TABLE 3

ADULT AND SUBADULT DESERT GERBILS IN THE 1963-64 AND 1966-67 POPULATIONS

—	Jan.-June		July-December		d = normal deviate between subadult population in the two halves of year
	Adult	Subadult	Adult	Subadult	
			Male		
1963-64 ..	36	17	83	1	4·76*
1966-67 ..	87	34	170	15	4·44*
			Female		
1963-64 ..	67	79	77	15	6·75**
1966-67 ..	123	53	161	19	4·78*

*Significant at 5 per cent level of probability.
** Significant at 1 per cent level of probability.

first half of the year (January to June) is significantly higher than those collected during the second half of the year (July to December). This would suggest that the rate of reproduction in desert gerbils is higher during the first half of the year as compared to that in the latter half.

SEX RATIO

Table 4 shows the monthly and yearly sex ratios observed in the two samples. For purposes of comparison, the sex ratio observed in collection made earlier (Prakash 1962) have also been included. It can be seen from the Table that the numbers of male in the 1953-55 collection was slightly more than 50 per cent but in the latter collections, it never reached the 50 per cent level. The yearly ratios in the 1953-55 and 1966-67 samples do not depart from the hypothetical 50 : 50 male-female ratio but during 1963-64 the male desert gerbils are significantly [$x^2(1)=27{\cdot}4, P < {\cdot}01$] less in number in the yearly sample, being only 36·5 per cent of the total. During both the years the numbers of male subadult gerbils was also significantly less than that of female subadult gerbils

TABLE 4

SEX RATIO IN THE DESERT GERBIL DURING 1953-55, 1963-64 AND 1966-67

—	1953-55			1963-64									1966-67								
	Adult & Subadult			Adult			Subadult			Total			Adult			Subadult			Total		
	♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂
January	22	26	45·8	2	9	18·1	0	20	0	2	29	6·4	33	45	42·3	20	14	58·8	53	59	47·3
February	8	9	47·0	8	12	40·0	11	14	44·0	19	26	42·2	18	45	28·5	8	21	27·5	26	66	28·2
March	8	11	42·1	13	28	31·6	1	27	3·5	14	55	20·2	36	33	52·1	6	18	25·0	42	51	45·1
April	5	4	55·5	3	12	20·0	1	10	9·1	4	22	15·3	—	—	—	—	—	—	—	—	—
May	4	4	50·0	4	1	80·0	4	7	36·3	8	8	50·0	—	—	—	—	—	—	—	—	—
June	2	2	50·0	6	5	54·5	0	1	0	6	6	50·0	—	—	—	—	—	—	—	—	—
July	5	6	45·4	6	2	75·0	—	—	—	6	2	75·0	33	31	51·5	1	0	100·0	34	31	52·3
August	10	7	58·8	39	32	54·9	1	3	25·0	40	35	53·3	50	28	64·1	0	0	0	50	28	64·1
September	13	12	52·0	25	24	50·2	—	—	—	25	24	50·2	19	17	52·7	4	1	80.0	23	18	56·1
October	9	4	69·2	—	—	—	—	—	—	—	—	—	33	46	41·7	7	8	46.6	40	54	42·5
December	8	8	50·0	13	19	40.6	0	12	0	13	31	29.5	35	39	47·3	3	10	23·1	38	49	43·6
Total	94	93	50·2	119	144	45·2	18	94	16·1	137	238	36·5	257	284	47·5	49	72	40·5	306	356	46·2

in respective populations (1963-64, $P < \cdot 01$; 1966-67 $P < \cdot 05$). This poor representation of subadult male gerbils could possibly be due to three reasons : the number of males was very low among the new born, trap reaction was different with respect to male and female subadult gerbils, and mortality of male subadults was more as compared to that of female subadults.

It is very unlikely that the number of males was lower at the newborn stage. This view is supported by the observed sex ratios of newborn in the northern palm squirrel, *Funambulus pennanti* Wroughton and Indian gerbil, *Tatera indica indica* Hardwicke which inhabit the same locality. The male to female ratios of these species have been reported as 1·1 : 1 (Purohit *et al.* 1966) and 1·1 : 1 (Jain 1970) respectively. In young desert gerbil also, it is quite likely that both the sexes would be represented in equal numbers.

If trapability of male and female young was different, it may be the reason of poor representation of male subadults in the population of 1966-67, but during 1963-64 the desert gerbils were collected by flooding their warrens and, therefore, their trap response cannot be a factor responsible for the low number of male subadults.

It is quite likely that mortality rate in male subadults is much more than that in females. A low number of male subadults have also been observed in the palm squirrel (Purohit *et al.* 1966), and in the Indian gerbil (Jain 1970). Since the male desert gerbil increases its home range when it attains sexual maturity and during the breeding season (Fitzwater & Prakash 1969), the maturing male gerbils have to, therefore, encounter hostile behaviour from other territorial adult males and it can be expected that in the process a substantial number of young perish. In addition to the mortality caused by social interactions, some subadult male desert gerbils may also die as they are less adaptable to xeric conditions as compared to female gerbils (Ghosh, Pers. Comm.). A higher rate of mortality may be the possible reason of the poorer representation of male subadult gerbils in the populations as compared to that of female subadult gerbils.

Summary

During 1963-64, the Indian desert gerbils, *Meriones hurrianae* Jerdon were collected by flooding their burrows whereas during 1966-67 they were trapped in Sherman live trap at the Research Farm of the Institute at Jodhpur.

The mean monthly body weights of adult desert gerbils fluctuated around 60 gm. during 1963-64 and around 70 gm. in the period 1966-67. The body weight trend through the years apparently ran parallel to the availability of food in the desert, the minimum weight being during

summer when food available is also minimal and the maximum weight corresponding to the period of monsoon when abundant green food is available. Male adult desert gerbils were found to be heavier than female adult gerbils.

The proportion of subadult gerbils in the population during 1963-64 was significantly higher ($P < \cdot 01$) than those in the 1966-67 population. It is attributed to different modes of collection. Due to flooding action even those young gerbils were collected during 1963-64 which do not venture out of burrows. During 1966-67, however, these were absent as they were not available for trapping. The male subadult gerbils were significantly ($P < \cdot 01$) less than subadult females during both the years. The distribution of subadult gerbils in various months indicate that the reproductive rate of desert gerbil is higher in the first six months of the year as compared to the later six months.

During 1966-67 the male-female ratio did not deviate from the hypothetical 50 : 50 ratio but in the 1963-64 population it was 1 : 1·74, the difference being significant ($P < \cdot 01$). Similar was the case with subadult gerbils. The poor representation of male sub-adults in the population is attributed to their higher rate of mortality mainly due to hostile intraspecific interactions and due to their lesser adaptability to the xeric environment, as compared to female merion gerbils.

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